SOHO Sungrazing Comets: Their History, Evolution, and Tails

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The temporal distribution of the SOHO sungrazers is known to be episodic on a timescale of several hours, with objects arriving in pairs much too often to be random. The pairs are readily understood as products of secondary, low-velocity, nontidal fragmentation events, which occurred virtually spontaneously at very large heliocentric distances, some before, others after, aphelion. The broken objects were in turn products of near-perihelion, tidal splitting of parent fragments during their previous return to the Sun. The pairs are extreme manifestations of larger clusters of such subnuclei, with a complex hierarchy of fragments. The same scenario of nontidal, progressive disintegration was firmly established for comet Shoemaker-Levy 9 (D/1993 F2). Also, there are distinct similarities with the mechanism recently proposed for the formation of striations in the dust tail of comet Hale-Bopp (C/1995 O1).

A study of tails of 11 SOHO sungrazers provides information on dust ejected from these comets and on the forces that the microscopic grains involved are subjected to. Images taken at times of the SOHO spacecraft's transit across orbit planes of sungrazers suggest relatively low particle ejection velocities in the direction normal to the orbit plane (not more than $\sim$100 m/s) and offer no evidence whatsoever for any effects of the Lorentz force on charged dust. When viewed broadside, sungrazers' tails are always narrow, either straight or slightly curved, and deviating strikingly from the antisolar direction, an indication that no microscopic dust was ejected during a period of time just preceding observation. The tails include a major population of submicron-sized grains that are dielectric in nature, most probably silicates, as the radiation pressure accelerations are found never to exceed 0.6 the solar attraction. Nearly all sampled comets show consistently that the production of this dust terminated at heliocentric distances between $\sim$20–30 solar radii along the inbound leg of the orbit. A simple model is fitted to the tail of one of the SOHO's brightest sungrazers, whose curvature abruptly increases at a point approximately halfway between the head and the tail's far end.

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